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Classification and productivity of winter pastures in Lankaran-Mugan botanical-geographical region

E.M. Gurbanov*, H.Z. Huseynova

Baku State University, 23 Academician Z.Khalilov Str., Baku AZ1148, Azerbaijan
***For correspondence**: Elshadqurbanov@bsu.edu.az*

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In order to ensure food security of the population in Azerbaijan, it is important to protect natural forage plants, effectively use, improve and prevent the process of biodiversity degradation. From this point of view, we aimed to study the parameters of semi-desert and desert formations, fodder quality, grazing norms, ecological assessment of semi-desert and desert formations, which are a valuable source of fodder for livestock in the Caspian coastal areas and vegetation of Lankaran administrative districts (southern part of the Caspian coast). The vegetation of the botanical-geographical region is spread below sea level - below 10 meters (in Masalli region), as well as at an altitude of 27 m to 150 m. During the ecological-geobotanical researches in the Lankaran-Mugan botanical-geographical area of Azerbaijan, phytocenoses with predominance of *Petrosimonieta brachiata* and *Artemisietum lerchiana-Ephemerosum* were registered in the desert and semi-desert vegetation types, which are mainly a source of natural fodder in winter pastures. A classification scheme for 6 formation groups and 8 associations was prepared, and an "Ecological-geobotanical map of the southern part of the Caspian coast. Scale 1: 10,000" was compiled. In the course of the study, endemic species of the Caucasian area - *Iris musulmanica* Fomin, *Salsola nitraria* Pall, *Symphytum caucasicum* M. Bieb., and endemic species of the Azerbaijan area - *Bellevalia zygomorpha* Woronow and Tragopogon macropogon C.A.Mey were identified.

***Keywords**: Ecosystems, phytocenosis, formation, association, dominant, subdominants, endemic*

INTRODUCTION

As indicated in the Law on "State Land Cadastre, Land Monitoring and Land Management", State Program on Rational Use of Summer and Winter Pastures, Hayfields and Prevention of Desertification in the Republic of Azerbaijan, as well as, in the action plan of the "Strategic Roadmap for the production and processing of agricultural products in the Republic of Azerbaijan" approved by Presidential Decree No. 1138 dated December 6, 2016, geobotanical research in pastures has become actual.

The vegetation of winter pastures is spread at an absolute height of -22 to 50 meters above sea level.

Climatic conditions are mild-warm and steppe type with dry summers; The average annual temperature is 14.4°C and the annual rainfall reaches 300 mm.

Vegetation groups are found in saline, saline gray-meadow, carbonate alluvial-meadow, meadow-swamp and sandy soils.

The main aim of the presented research was to determine the structure, productivity, nutrition and capacity of wormwood-ephemeral formation *Artemisietum-Ephemerosum* of semi-desert phytocenosis and *Petrosimonieta brachiata* formation of the most widespread desert vegetation in the state-owned winter pastures which is a source of natural fodder for the development of nomadic small horned animals, mainly in the Lankaran-Mugan region.

In connection with the purpose of the scientific topic were conducted geobotanical researches in the spring, autumn and winter seasons of 2019 in the desert and semi-desert vegetation spread on the southern Caspian coast, as well as in the winter pastures of Lankaran-Mugan region. Moreover,

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was planned to determine the following tasks. In the next must be resolved:

- recording the species composition and structure of phytocenoses;
- compilation of modern classification;
- determination of productivity on plant groups;
- determination of nutrition (feed quality) based on biochemical analysis;
- calculation of the load and capacity of pasture area.

MATERIALS AND METHODS

Within the territory of the Republic of Azerbaijan, plant groups on natural forage areas within the South Caspian coast, Lankaran-Mugan botanical-geographical region (Gurbanov, 2018) are spread in saline, saline gray-meadow, carbonate alluvial-meadow, meadow-swamp and sandy soils. The Lankaran-Mugan botanical geographical area is considered to be a source of natural fodder for the development of nomadic sheep-breeding, as well as a widespread desert plant in state-owned winter pastures. Species composition, structure, productivity, nutrition and capacity of *Petrosimonieta* and semi-desert *Artemisietum-Ephemerosum* formation were studied (Shukurov et al., 2008). Based on the results of phytocenoses productivity and feed quality, it was determined that the relevant geobotanical indicators of the area change depending on soil and climatic conditions.

Therefore, before analyzing the dynamic variability of the productivity of the selected "Research Objects", we studied the soil and climatic conditions characteristic of the region, based on the annual results of meteorological stations. (Abdullayev, 2007; Shikhlinsky, 2009).

During the research, geobotanical materials collected during the field research were analyzed by the route method, numerous herbariums were assigned to "Flora of Azerbaijan" on the basis of systematic taxa, and the names of the species were specified according to Cherepanov (1995), Askerov (2011), WFO (2021).

"Field geobotany" (Lavrenko, 1959-1976), "Methods of geobotanical research of natural forage areas" (Hajiyev et al., 1995), "Res. Instructions on geobotanical research of natural forage areas of the Republic of Azerbaijan" and "Methodical instructions on geobotanical research of natural forage areas of Azerbaijan" (Agaguliyev, 2001) were used. The productivity of winter pastures and rural pastures used as a source of fodder for the development of livestock in the administrative districts, the quality of fodder were studied and the capacity of pastures was determined.

The area is characterized by drought, as well as the widespread use of desert and semi-desert vegetation in the ecological conditions of desertification. One of the factors contributing to the desertification process is the degradation of vegetation due to overgrazing of natural forage areas, as well as fuel, construction, etc. cutting of trees and shrubs for purposes (Ibadullayeva et al., 2012; Hatamov, 2000). The refore, due to anthropogenic and man-made influences in the vegetation of the studied region, shrubs have become very sparse, pasture productivity has decreased and nutrients have been depleted.

Information on the improvement of natural winter pastures in the country, including florostatic and geobotanical studies of semi-desert and desert plants (Hajiyev, 1995; Aliyev, 1965; Mailov, 1984; Agadjanov, 1967; Gurbanov et al., 2012; Gurbanov, 2004; Ibadullayeva, 2011; Shukurov et al., 2008).

RESULTS AND DISCUSSION

According to the "General scheme of use of natural fodder lands of the Republic of Azerbaijan till 2005" and "Map of lands of large-scale administrative territory of Lankaran-Mugan region", the total area of winter pastures of the region is 22476,0 ha; of which 12552.0 ha (55.8%) are explored areas and 9924.0 ha (44.2%) are unexplored areas (Table 1).

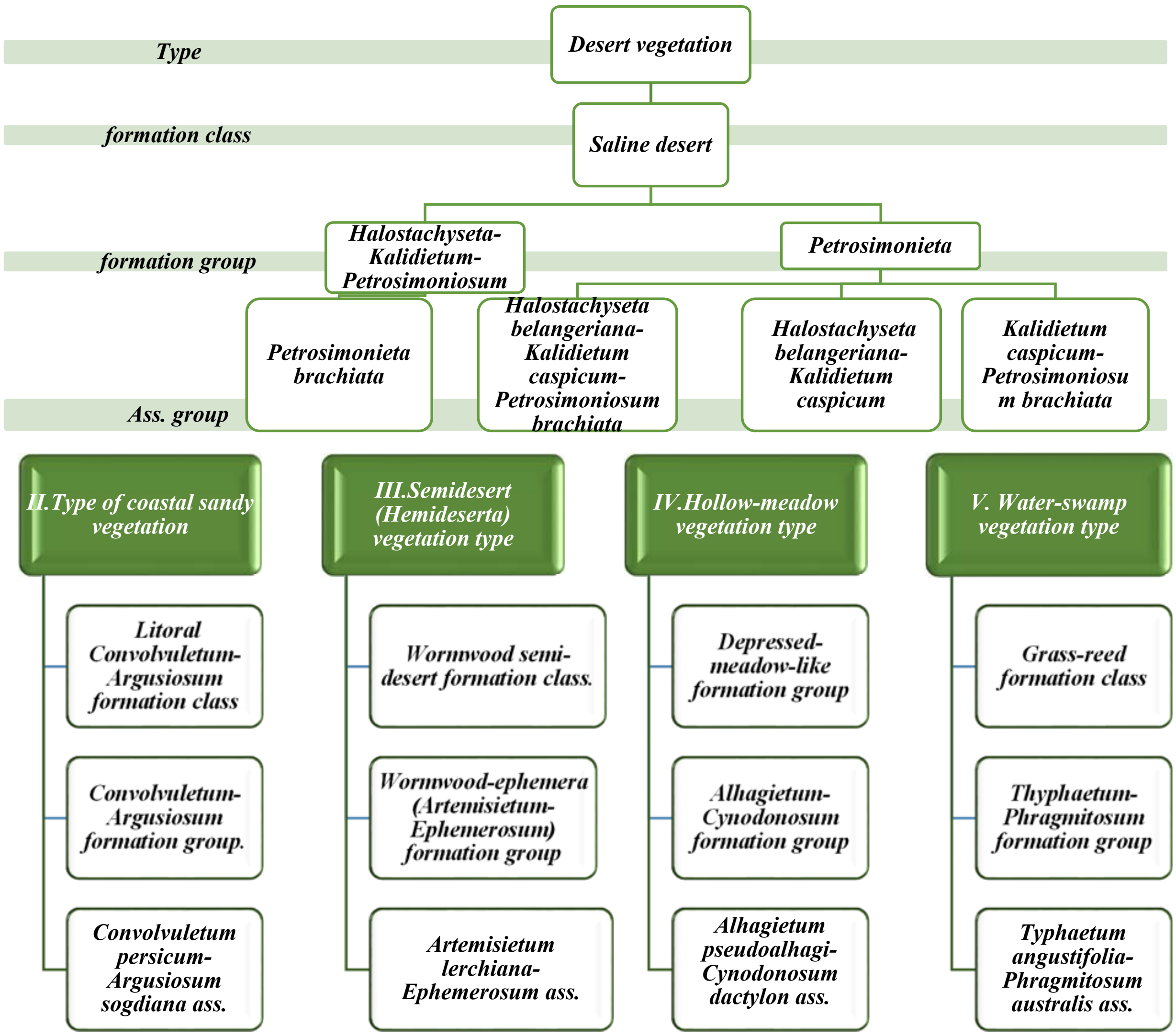
As shown in the table, the area of *Petrosimonieta brachiata* formation is 4550.0 ha (20.2%) and the area of wormwood-ephemeral *Artemisietum lerchiana-Ephemerosum* is 8002.0 ha (35.6%). And first of all, was a task to complete of "Ecological-geobotanical map of the southern part of the Caspian coast (scale 1:10.000)". According

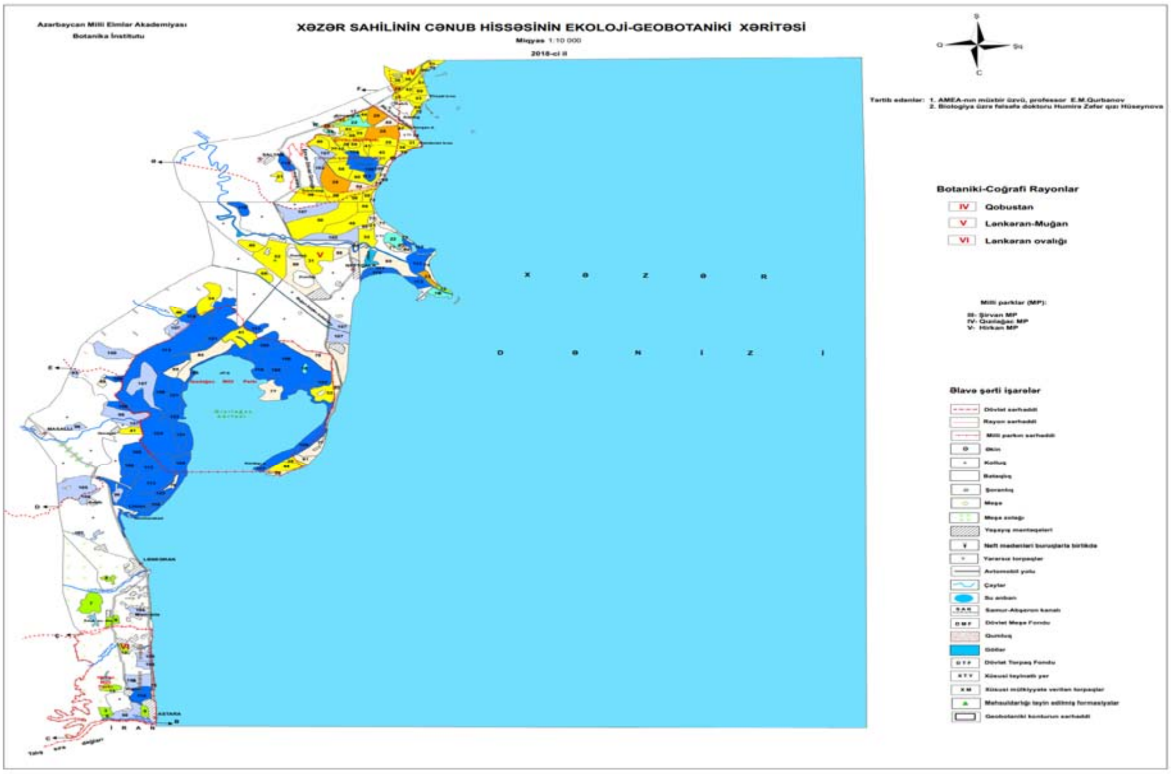
to geobotanical instructions and modern methodology, our research on the southern Caspian coast, as well as in the Lankaran-Mugan region, allowed us to classify the vegetation found in winter pastures. According to the results of phytocenological research, 5 plant types, 5 formation classes, 6 formation groups and 8 associations are widespread in the winter pastures of the region.

Table 1. Classification and areas of winter pasture vegetation

Counter№	Classification index	Types and formations (dominant and subdominant species)	Area within the border	
			with ha	with %
1	S-III-31	Desert Vegetation (*Petrosimonieta brachiata*)	4550,0	20,2
2	S-III-34	Semidesert vegetation (*Artemisietum lerchiana-Ephemerosum*)	8002,0	35,6
Explored areas			12552,0	55,8
Unexplored areas			9924,0	44,2
Total area			22476,0	100,0

Classification scheme





Map 1. Ecological-geobotanical map of the southern part of the Caspian coast. **Scale1: 10,000; 2018.** *Institute of Botany of the National Academy of Sciences of Azerbaijan; Compiled by: Corresponding Member of ANAS E.M. Gurbanov, Doctor of Philosophy in Biology H.Z. Huseynova*

A brief description of the species composition and structure of the studied *Petrosimonieta* and *Artemisietum-Ephemerosum* formations is given below.

Petrosimonieta phytocenosis is found as an indicator formation in saline soils. 16 species were recorded in the formation composition. Of these, 2 species (12.5%) belong to shrubs, 1 species (6.3%) to small semi-shrub, 6 species (37.5%) to cereal grass and 7 species (43.7%) to various grass species.

The monodominant of this formation is *Petrosimonia brachiata (*Pall.) Bunge., The abundance of which is estimated at 3-4 points.

According to the geobotanical description, the phytocenosis is single-storey and the average height of grass cover reaches 10-30 cm. The overall design or projective coverage corresponds to 40-60%. The productivity of the formation is 8.6 cent/ha in dry mass ingested.

The average annual productivity of the *Petrosimonieta* formation was (20.IV) -2.05s / ha (23.3%) cereal grasses, 1.2s / ha (13.9%) legumes in the spring of the year (for 2019) and 2.8 s / ha (32.6%) and 2.6 s /ha (30.2%) various grass species in the fall.

As a result of biochemical analysis, hygroscopic moisture, crude ash, crude protein, crude fat, crude cellulose were detected, as well as nitrogen-free extractives, feed unit and assimilated protein were calculated based on the results of these analyzes. Therefore, the productivity and feed unit for the identified formations was considered the main criterion in the "plant block". In this regard, the formations are divided into quality groups (good, medium and low categories) according to their nutritional value and productivity. Based on the biochemical parameters of phytocenoses, the conversion of crude ash (A1), protein (P1), fat (F1) and nitrogen-free extractives (N1) in each formation is calculated according to the following formula:

Table 2. Area of winter pastures by formations, productivity, nutrition and pasture capacity

№	Name of the formation	Type of pasture	Area within the border		Productivity (in dry mass cent/ha)	In 100 kg of dry feed, in kg		Pasture capacity (at the expense of the main herd)	
			ha	%		Fodder unit	Assimilated protein	one ha	Total area
1	Petrosimonieta	Saline	4550,0	20,2	8.6	32,8	3,3	1,0	4550
2	Wormwood-ephemeral	Clean	8002,0	35,6	10,4	44,2	4,5	1,7	13603
Explored area			12552,0	55,8					
Unexplored area			9924,0	44,2					
Total area			22476,0	100,0					

$$P_1 = \frac{P \times 100}{d \cdot m};$$

P_1 - absolute dry matter protein (in%), P - crude protein per 100 g of dry mass in air (in%), d·m - dry matter (in%) in the mass of edible dry grass.

It should be noted that A1, F1, N1 are calculated in the same way as above.

According to the laboratory analysis of the main fodder plants, the biochemical composition of the phytocenosis has a hygroscopic moisture of 12.0%, ash in absolute dry matter 9.4%, protein 6.8%, fat 2.4%, cellulose 33.9%, NFE-35.5%, the feed unit per 100 kg of feed is 32.8 kg and the assimilated protein is 3.3 g (Table 2).

Taking into account the nutrition of the formation in the field of *Petrosimonieta* of the South Caspian coast fodder unit (per 100 kg of fodder) productivity (8.6 s/ha), grazing period (210 days), daily fodder norm of cattle (1.3 fodder units), the load of *Petrosimonieta* (1 head per hectare), the capacity was determined to be 4550 heads.

2. *Artemisietum Ephemerosum* phytocenosis is found in saline gray-meadow soils. There are 21 species of plants in the formation, of which 1 species (4.8%) is semi-shrub, 1 species (4.8%) is small semi-shrub, 7 species (33.3%) are cereal grasses, and 12 species (57.1%) are various species grass.

Abundance of edificator of the formation, as well as subdominant type *Artemisia lerchiana* Web. 2-3 points; dominant species-(*Eremopyrum orientale* (L.) Jaub.et Spach) *Lolium rigidum* Gaudin., *Rabbit barley* (*Hordeum leporinum* Link.), etc. are ephemerals, the abundance of which is 3-4 points.

According to the structure of the phytocenosis, the tier is two-storied; On the first floor there are *Artemisia lerchiana* and on the second floor there are ephemerals mentioned earlier. The average height of grass cover reaches 10-40 cm. The total project coverage is 70-90%.

The productivity of the formation is 10.4 s / ha per dry ingested mass.

The productivity of this formation by botanical groups in the spring of 2019 was 2.2 s/ha (21.1%) of cereal grass, 1.4 s/ha (13.5%) of legumes; 3.8 s/ha (36.6%) in autumn and 3.0 s/ha (28.8 s/ha) various species grass in winter.

The biochemical composition of the phytocenosis in which forage crops are found is 13.0% of hygroscopic moisture, 6.6% of ash in absolute dry matter, 8.9% of protein, 2.7% of fat, 26.8% of cellulose, 42.0% of NFE; the feed unit of 100 kg of fodder plant is 44.2 kg and the assimilated protein is 4.5 g.

Taking into account the nutrient content of the formation (feed unit per 100 kg of feed), productivity (10.4 s/ha), grazing period (210 days), daily feed rate (for cattle), the load of winter pasture is 1.7 heads per hectare, and the total area is 13603 heads was determined.

Thus, it is recommended to graze 18,153 heads of small cattle in the winter pastures surveyed in the Neftchala region on the South Caspian coast.

Based on the geobotanical characteristics of desert and semi-desert vegetation spread on the studied South Caspian coast, we recommend the following measures for scientifically and practically efficient use and improvement of winter pastures:

- carrying out autumn (partial) grazing by individuals and legal entities with the application of pasture rotation;

- implementation of root and surface improvement measures in pastures subject to salinization and salinization;
- sowing of valuable fodder (wild and cultivated) plants adapted to soil and climatic conditions, as well as provision of organic and mineral fertilizers in accordance with agro-technical rules;
- -proper (efficient) use of pastures during the vegetation period of fodder crops after vegetation restoration.

The study analyzed the classification of desert, coastal sandy, semi-desert, meadow and wetland vegetation types found in winter pastures in Lankaran-Mugan region up to formation class, formation group and association groups and determined their phytocenological composition.

The productivity of some formations found in the region was studied, the amount of dry fodder mass was determined.

The application of these mentioned measures in the pastures of the South Caspian coast will create a basis for the protection of natural phytocenoses and wild flora, as well as the protection of the environment.

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Lənkəran-Muğan botaniki-coğrafi rayonunun qış otlaqların təsnifatı və məhsuldarlığı

E.M. Qurbanov, H.Z.Hüseynova

Bakı Dövlət Universiteti, Bakı, Azərbaycan

Azərbaycanda əhalinin ərzaq təhlükəsizliyini təmin etmək üçün təbii yem sahələri bitkiliyinin qorunması, biomüxtəlifliyin səmərəli istifadəsi, yaxşılaşdırılması və degradasiya prosesinin qarşısının alınması üçün elmi-praktiki əsasların işlənilməsi vacibdir. Bu baxımdan Xəzər sahili Lənkəran-Muğan botaniki-coğrafi ərazisində heyvandarlığın dəyərli yem mənbəyi sayılan yarımsəhra və səhra fitosenozlarının məhsuldarlığının dinamikası, yem keyfiyyəti, otarma norması və torpaqlarının ekoloji qiymətləndirilməsi üzrə parametrlərinin araşdırılması qarşıya məqsəd olaraq qoyulmuşdur. Cənubi Xəzər sahilinin Lənkəran-Muğan botaniki-coğrafi rayonunun qış otlaqlarında ekoloji-geobotaniki tədqiqatlar ilk dəfə tərəfimizdən aparılmışdır. Tədqiqat nəticəsində ərazisində qeydə alınan köçəri qoyunçuluğun inkişafı üçün təbii yem mənbəyi hesab olunan, eləcə də dövlət mülkiyyətində saxlanılan qış otlaqlarında ən geniş yayılmış səhra bitkiliyinin qışotuluq (*Petrosimonieta*) və yarımsəhra fitosenozun yovşanlı-efemerlik (*Artemisietum-Ephemerosum*) formasiyalarının növ tərkibi, quruluşu, məhsuldarlığı, qidalılığı və tutumu öyrənilmişdir. Qeyd edilən formasiyaların qış otlaqlarında təsifastına əsasən 5 bitkilik tipi, 5 formasiya sinfi, 6 formasiya qrupu və 8 assosiasiyalarda təmsil olunduğu aşkar olunub. Eyni zamanda "Xəzər sahilinin cənub hissəsinin ekoloji-geobotanik xəritəsi" (Miqyas 1: 10 000) tərəfimizdən tərtib edilmişdir. Tədqiqat zamanı ərazinin bitkiliyində Qafqaz areallı endemiklərdən–*İris musulmanica, Salsola, nitraria, Seymphytum caucasicum*, Azərbaycan areallı endemiklərdən–*Bellavalia zigomorfa* və *Tragopogon macropogon* növləri aşkar olunmuşdur.

Açar sözlər: *Ekosistemlər, fitosenoz, formasiya, assosiasiya, dominant, subdominantlar, endemik*

Классификация и продуктивность зимних пастбищ Ленкорань-Муганского ботанико-географического района

Е.М. Гурбанов, Х.З. Гусейнова

Бакинский государственный университет, Баку, Азербайджан

Для обеспечения продовольственной безопасности населения в Азербайджане важно защищать естественные кормовые растения, эффективно использовать, улучшать и предотвращать процесс деградации биоразнообразия. С этой точки зрения наша цель заключалась в изучении параметров полупустынных и пустынных фитоценозов, качества кормов, норм выпаса, экологической оценке полупустынных и пустынных фитоценозов, которые являются ценным источником кормов для скота в прибрежных районах Каспия, а также оценке растительности административных районов Ленкорань-Муганской ботанико-географической зоны (южная часть побережья Каспия). В ходе эколого-геоботанических исследований в Ленкорань-Муганской ботанико-географической зоне Азербайджана были зарегистрированы фитоценозы с преобладанием *Petrosimonieta brachiata и Artemisietum lerchiana-Ephemerosum* в пустынном и полупустынном типах растительности, которые в основном являются источником естественных кормов на зимних пастбищах. Разработана классификационная схема для 6 групп формаций и 8 ассоциаций, а также «Эколого-геоботаническая карта южной части побережья Каспийского моря. Масштаб 1: 10000». В ходе исследования были выявлены виды эндемиков Кавказского ареала - *Iris musulmanica, Salsola, nitraria, Seymphytum caucasicum* и эндемики Азербайджанского ареала - *Bellavalia zygomorph и Tragopogon macropogon*.

Ключевые слова: *Экосистема, фитоценоз, формация, ассоциация, доминанты, субдоминанты, эндемики*